Timing and Extent of Icing Events in Southwest Alaska During Winters 2001-2008

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Winter Icing Events

- Have potential for catastrophic effects on wildlife populations
- Icing has been implicated in large-scale die-offs
  - However, this has recently been questioned

Winter Icing Events

- Temperature often used as a proxy
- Lack of data across regions
- Thus we have limited understanding of:
  - Trends ,timing, distribution, severity of icing
  - Biological implications

Remote Sensing Technique

- New method by Bartsch et al. (2010):
  - Allows for detection across large areas
  - Detection based on changes in snow characteristics
  - Accurately detected known events

Bartsch et al. 2010

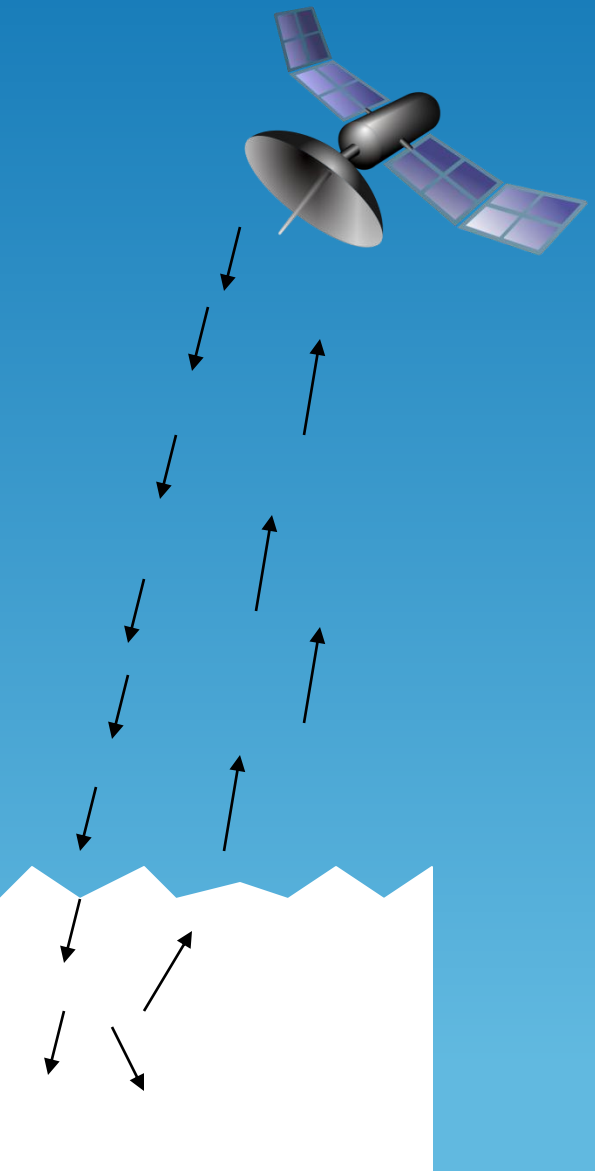
Objectives

- Obtain first measurements of:
  - Frequency of events
  - Timing of events
  - Distribution of events
- Establish baseline for long-term monitoring

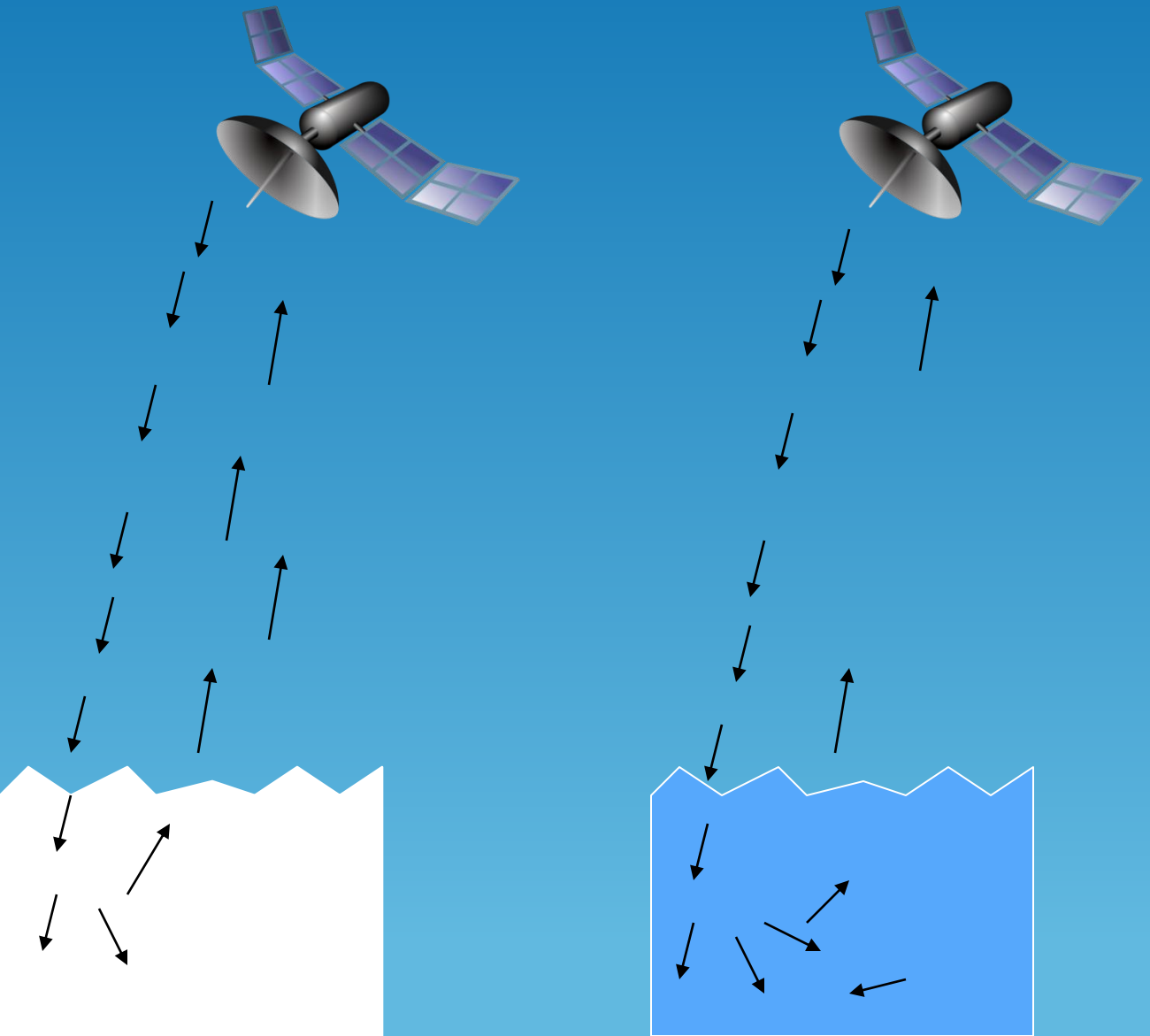
Satellite Data

- Seawinds on QuikScat:
  - Microwave backscatter data
  - 10 km resolution
  - Collected for winters 2001-2008
  - November-March
  - Satellite ended 2009

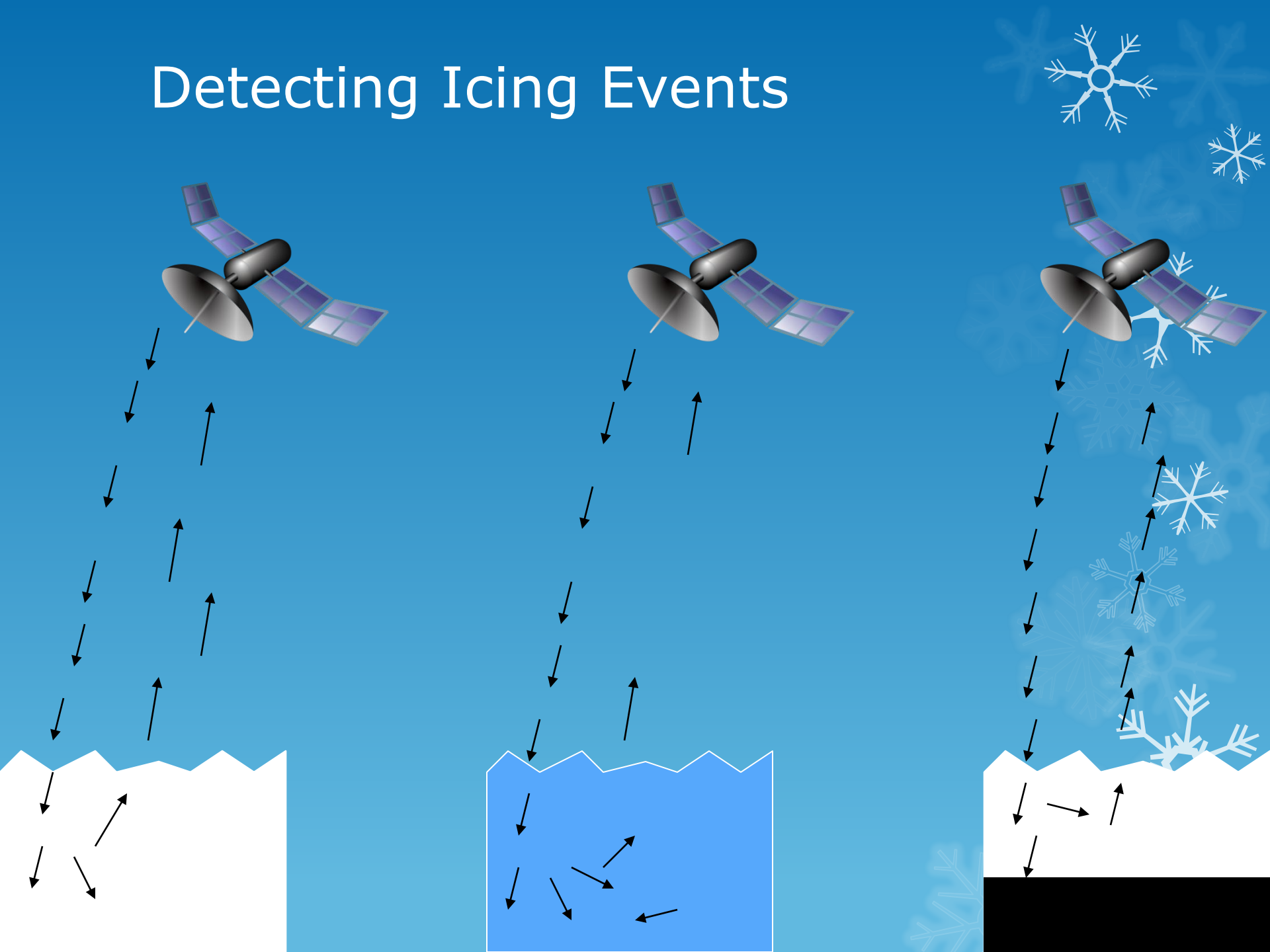
Detecting Icing Events



Detecting Icing Events

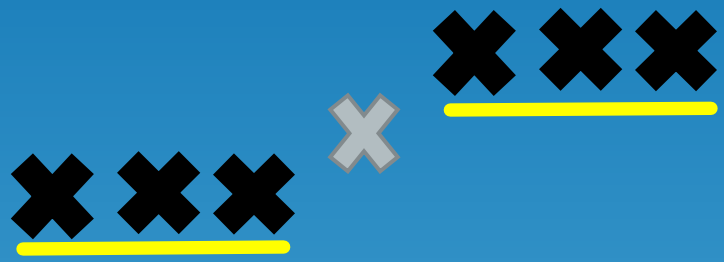


Detecting Icing Events



Methods

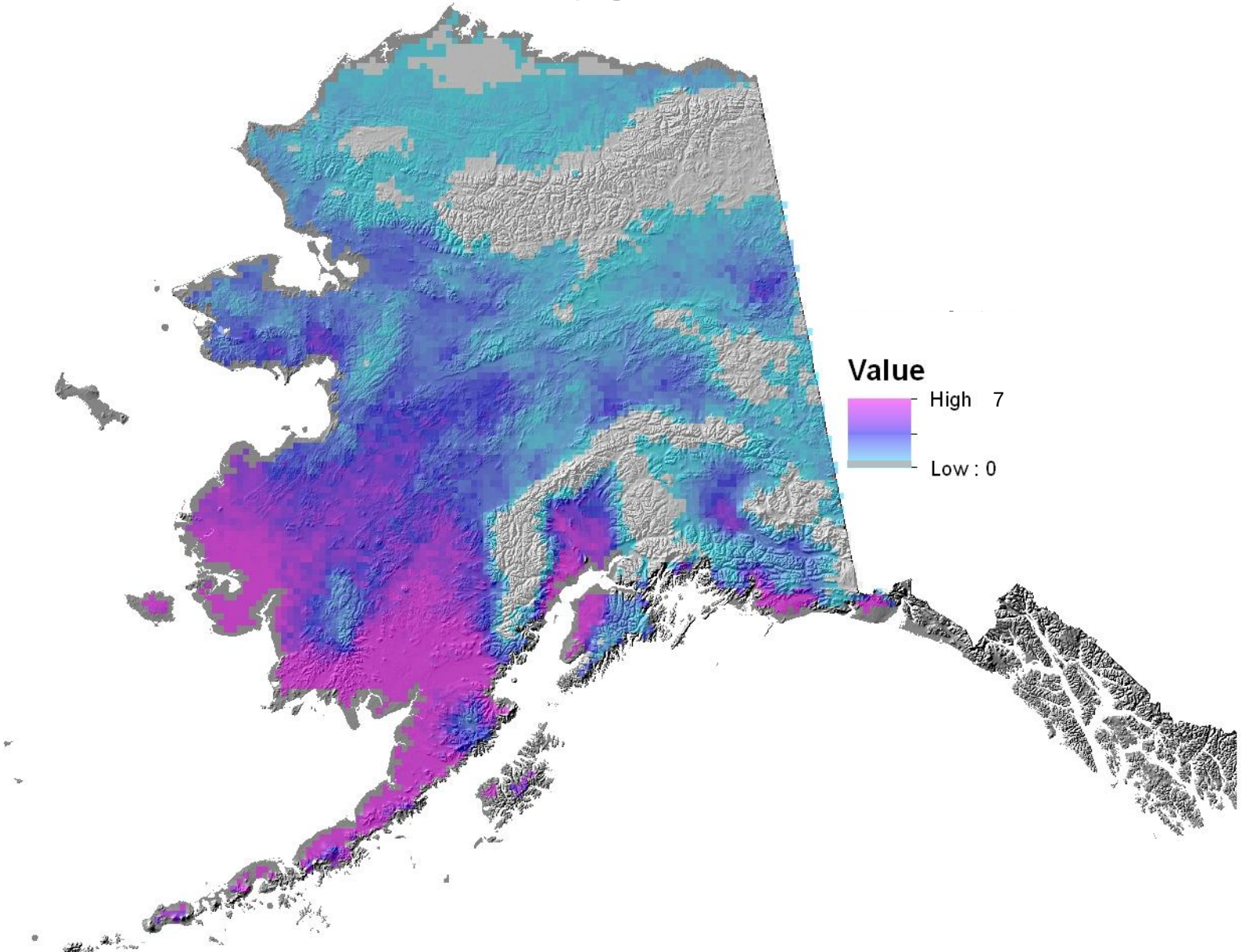
- Icing event detection:



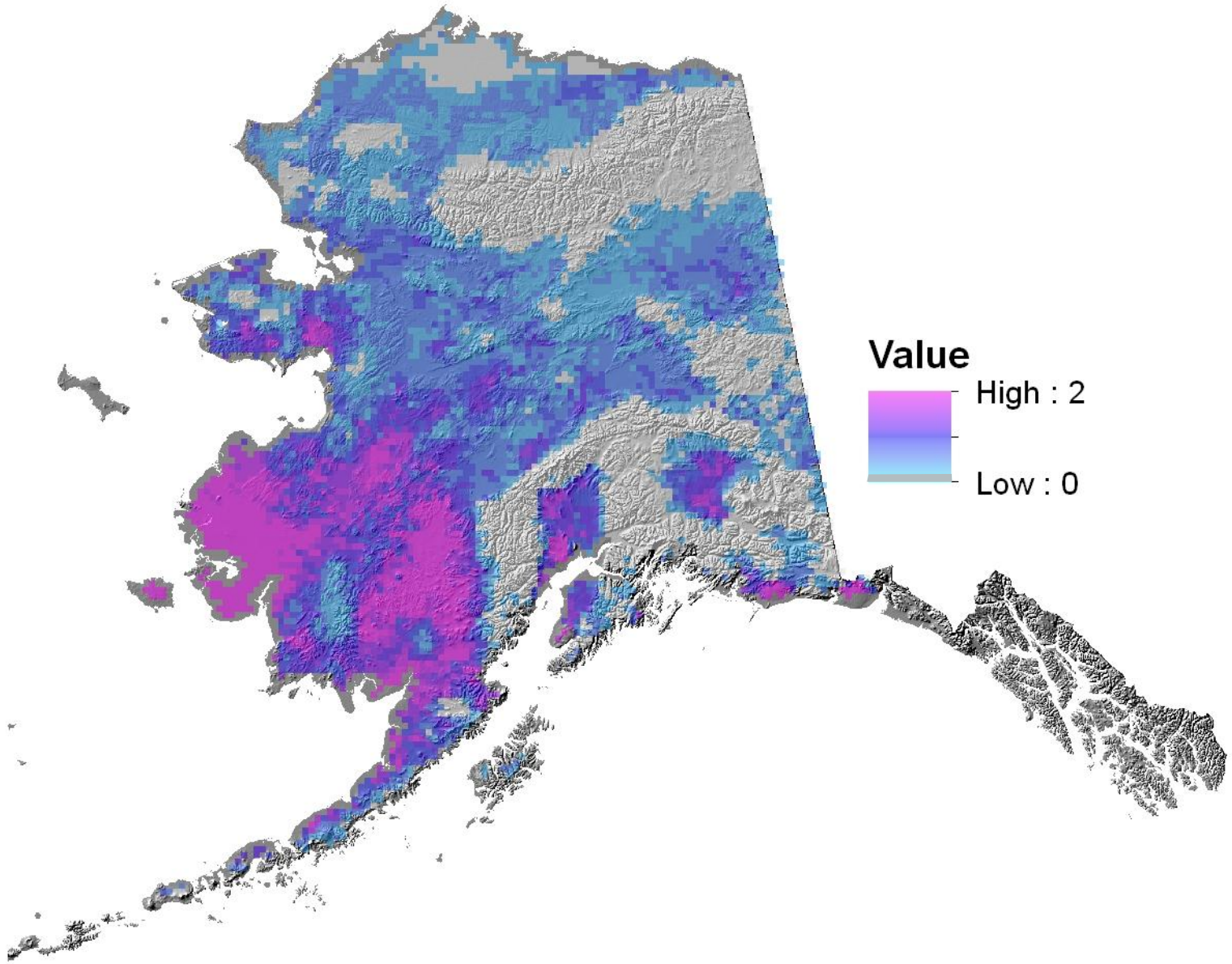
$$(\bar{x}_{+3d} - \bar{x}_{-3d}) \geq 1.5\ dB$$

- Restricted analysis to grids >12.5 km from coast
- Counted no. of events at each grid cell during study period
- Determined:
  - Avg. no. events/winter
  - Avg. no. events/month in winter

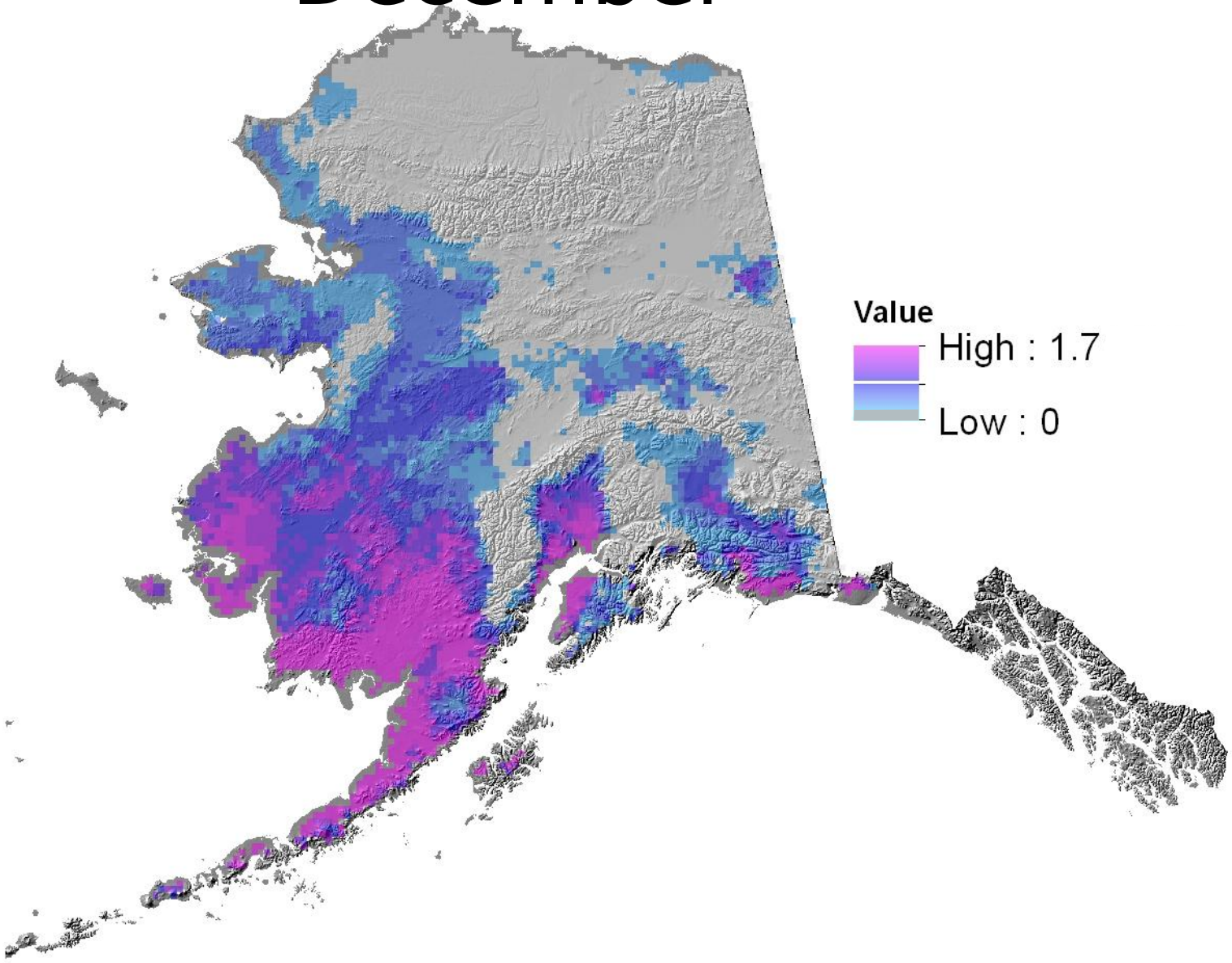
Average Number of Events Winter



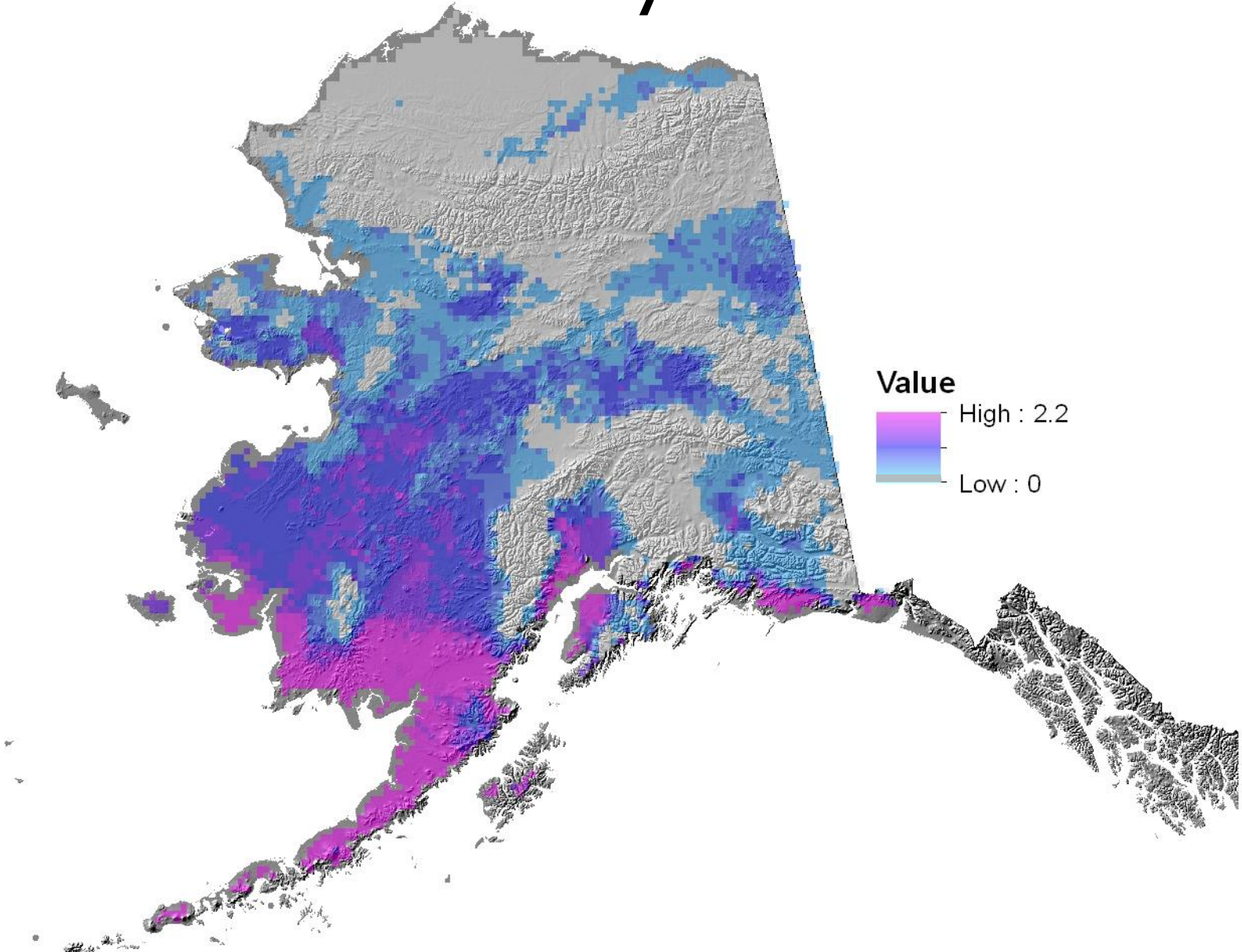
Average Number Events November



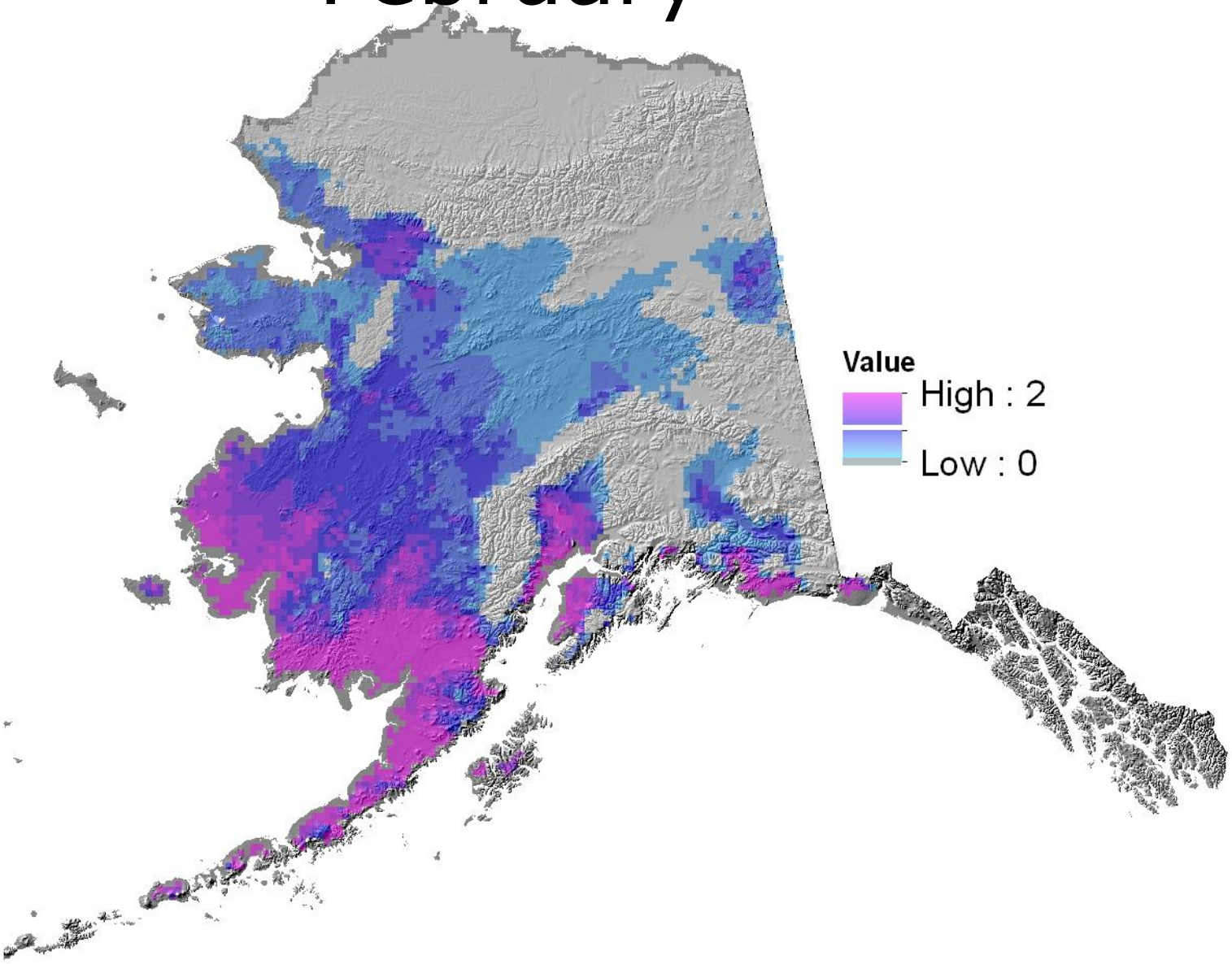
Average Number Events December



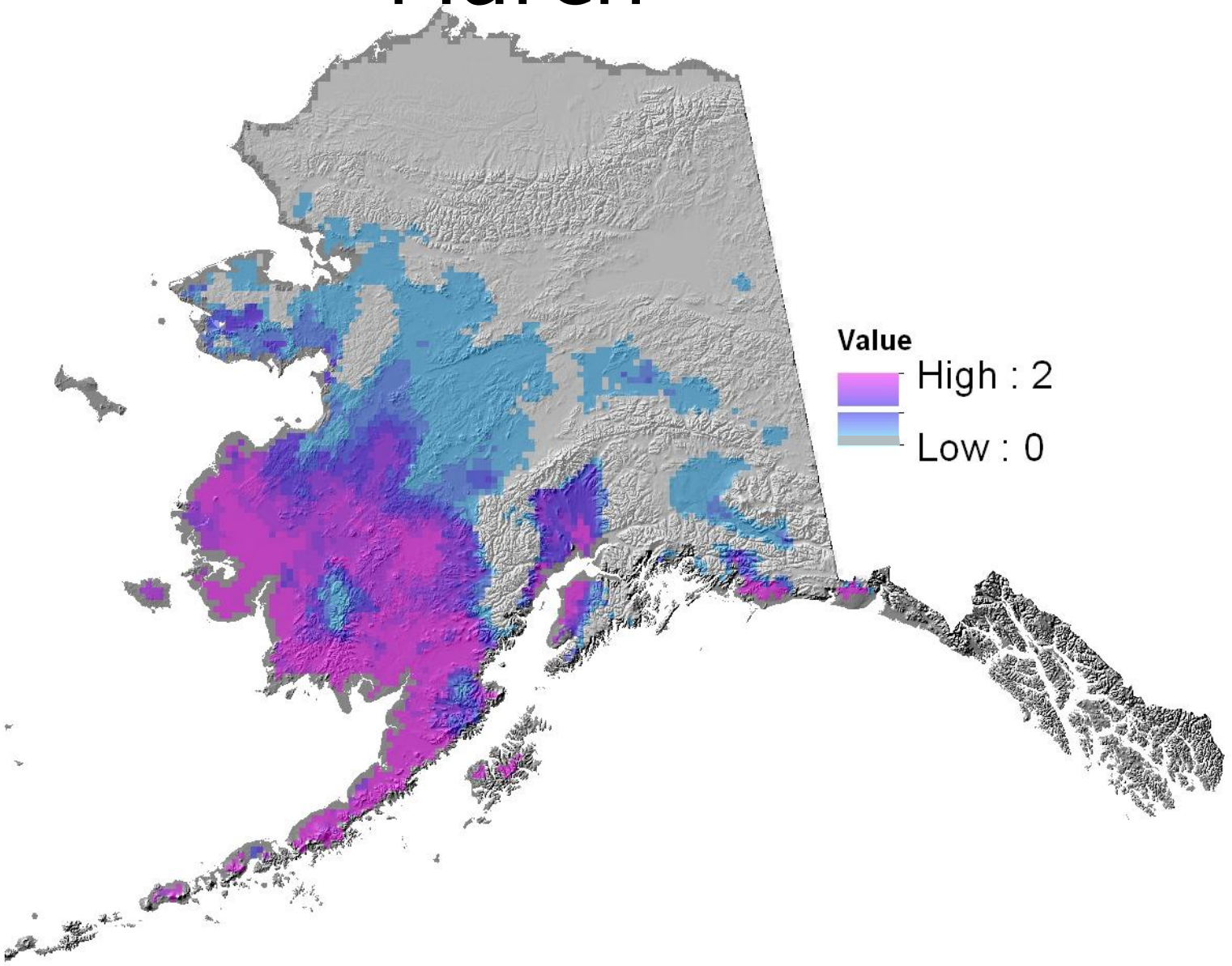
Average Number Events January



Average Number Events February



Average Number Events March



Validation: Weather Stations

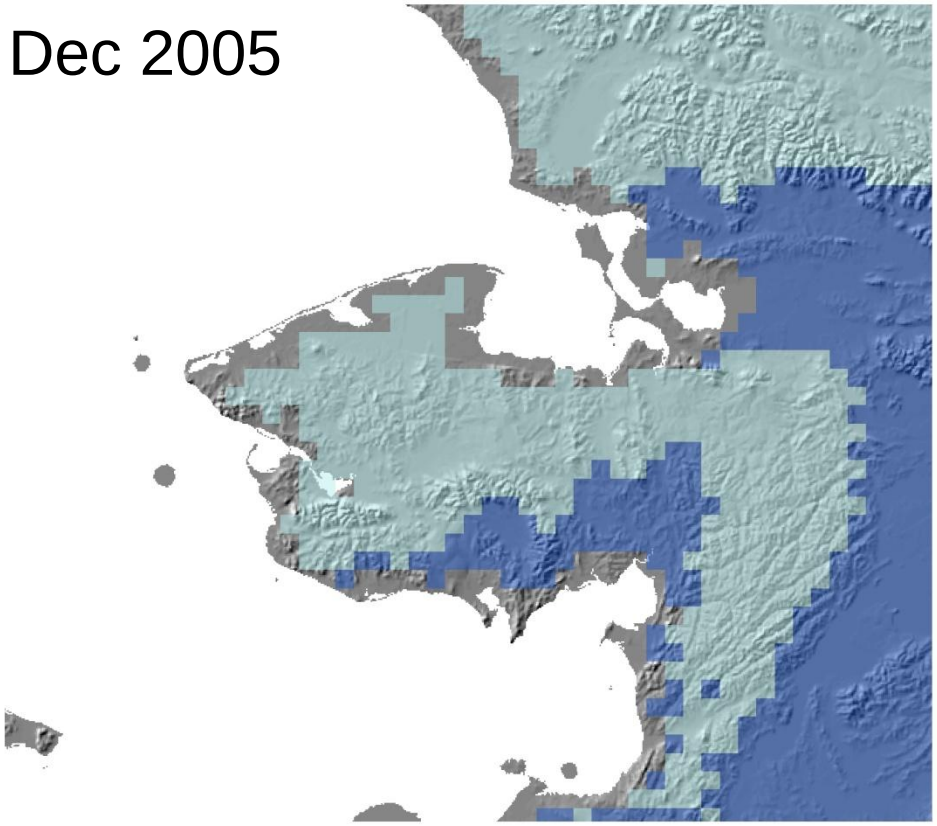
- Matched SNOTEL sites with closest grid cell
- If an icing event was detected
  - Determined if T_{max} > 0°C on detection day
  - Determined if ± 3 days had T_{max} > 0°C

- 83% of detections on days with T_{max} > 0°C
- 93% of detections with at least 1 day in 3 day window with T_{max} > 0°C

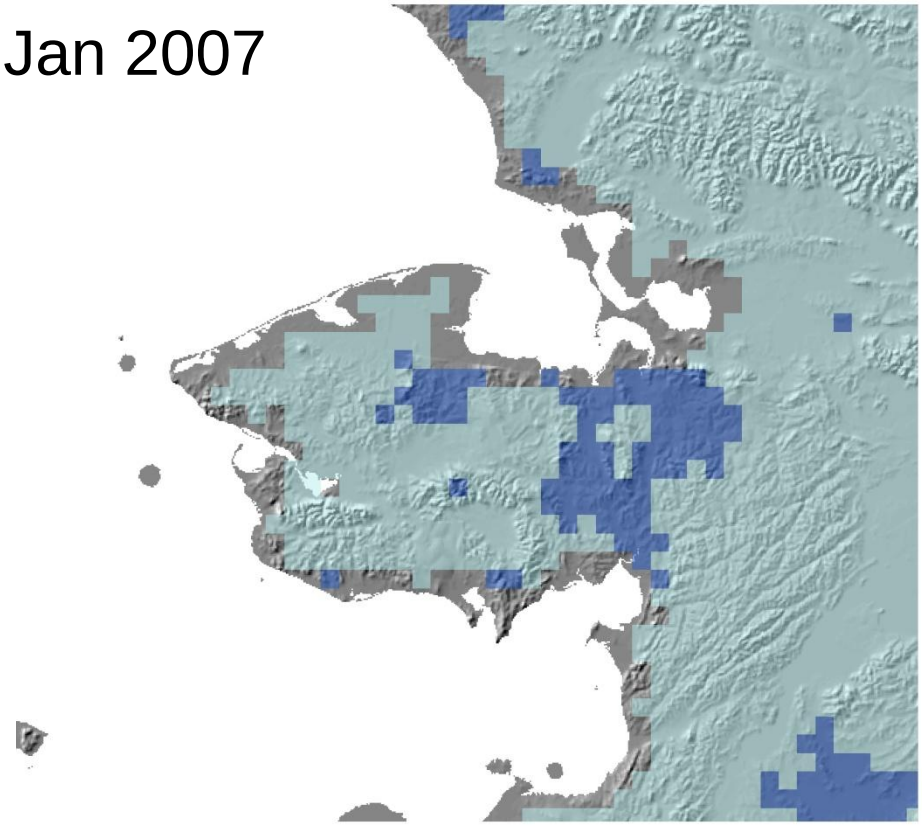
Validation: Observed Events

- Two events observed near Kotzebue
  - Dec 2005: Kotzebue to Unalakleet and onto Seward Peninsula
  - Jan 2007: Kotzebue south to Shaktoolik; 4 days of rain

Dec 2005



Jan 2007



Conclusions: Southwestern Alaska

- Highest frequency in SW Alaska
  - Some areas with > 7 events/winter
  - Low elevations adjacent to coast
- Frequency similar across winter
- Method detected **likely** & **known** events

Conclusions: Southwestern Alaska

- Not enough data to detect trends
- Yukon Delta NWR, Bristol Bay, and Alaska Peninsula "hardest hit"
- A possible mechanism for declines of Alaska Peninsula caribou herds?

Next Steps

- A new platform for detecting icing remotely?
- Develop mechanistic model of icing events
  - Determine how freq. will change with climate change
- Inform ground-based monitoring
- Wildlife responses to icing events

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